Research FOR FARMERS

WINTER - 1957

Chicks from private breeders randomized around foster mother in central production test (see story, page 11).

CANADA DEPARTMENT OF AGRICULTURE

Research FOR FARMERS

CANADA DEPARTMENT OF AGRICULTURE
Ottawa, Ontario

Rt. Hon. JAMES G. GARDINER, *Minister* — J. G. TAGGART, C.B.E., *Deputy Minister*

WINTER - 1957

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"*Research for Farmers*" is published quarterly by the Canada Department of Agriculture. Its purpose is to help keep extension workers informed of developments in research and experimentation as carried on by the various units of the Department.

NOTES AND COMMENTS

John N. Welsh whose article appears on page 5, was recently honored by Cornell University for his work in developing the Garry variety of oats. At the University's annual Seed School Mr. Welsh received a citation at the hand of Dr. S. S. Atwood, Provost of the University, in recognition of the contribution made by the Garry oat to the agriculture of New York State. Garry, which is resistant to all known North American races of stem rust and highly tolerant of leaf rust, occupied more than 30 per cent of the State oat acreage in 1956. It is expected to reach 75 to 80 per cent this year. In the absence of rust Garry yields at least 15 per cent more than standard varieties now being used in New York. Scientists at Cornell said that the introduction of Garry to the State "represents an excellent example of co-operation between outstanding plant breeders in Canada and the United States". And speaking about awards, Mr. George MacVicar who had a hand in the development of the Vicar hulless oat, was the recipient of a 1956 "Good Citizenship Award" from the Portage la Prairie, Man., Chamber of Commerce.

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For many years the term "small potatoes" has been firmly established in the language as a synonym for something inconsequential. This may soon be changed if a present trend continues. Some of the canning companies are now putting up packs of canned whole small potatoes, thus providing an outlet for an otherwise unmarketable product. As these canned potatoes become more familiar on the grocers' shelves, demand may reach really worthwhile proportions. One western firm operating in southern Alberta envisages an annual pack of 30,000 cases.

* * *

Agriculturists must be ever on the alert to guard against the introduction of foreign pests of various kinds. Fortunately the vigilance of our Plant Protection service turns back many potential enemies but despite their best efforts, occasionally new pests do find their way into the country. One such unwelcome visitor was detected in the spring of 1956. It is a European insect that attacks members of the plum family, and was discovered in the Niagara District of Ontario where it occurred in both orchards and nurseries. We don't know yet how serious the pest may prove to be but entomologists are keeping a close watch on it. Whenever readers encounter an unfamiliar weed, a strange insect attacking a crop, or other evidence of potential crop damage, a good plan is to send it to the nearest Experimental Farm, Entomology Laboratory or Plant Pathology Laboratory.

SOYBEAN BREEDING SUCCESSES

C. W. Owen

THREE world championships and two reserve awards at the Royal Winter Fair, Toronto, since its introduction in 1951 is the record of the Harosoy variety, one of the products of soybean research at the Harrow Experimental Farm. Harosoy has also placed first at the International Hay and Grain Show, Chicago. Hardome, another Harrow variety released two years later, has been a one-time winner at Toronto. These and other varieties selected or bred at Harrow have played a major part in the expansion of soybean production in Canada.

Prior to 1941 less than 11,000 acres of soybeans were grown annually in all Ontario. At that time an assured market for soybeans was established, a wartime demand for vegetable oils and protein developed, and combine harvesters were becoming more common. Soybean acreage increased to 41,000 in 1942 and thus began its phenomenal climb. Since 1952 the acreage has not been less than 200,000 acres and annually the total crop has exceeded 4 million bushels with a farm value of over ten million dollars.

During this expansion period the main soybean producing area was becoming established. It now comprises parts of the two largest producing counties Essex and Kent, and of the adjoining counties of Lambton, Middlesex, and Elgin. Some soybean acreage is distributed over a large section of Ontario extending eastward to Ottawa but about 95 per cent of the crop is grown in the five main counties. While this expansion was taking place the need for good varieties of different maturities became evident. In areas with short growing seasons, earlier maturing varieties are required. In the longer season areas growers of large acreages sometimes have used two varieties in order to spread their harvesting operations or used an early variety that could be harvested in time to plant fall wheat.

At the time the soybean acreage began to expand, only a few suitable varieties were available, all of which were the product of plant selection. These included A. K. (Harrow), Manchu, O.A.C. 211 and Mandarin (Ottawa). Of these only Mandarin (Ottawa) was an early variety. In the early 1940's the seed of the Manchu variety in the hands of growers had become considerably mixed. Fortunately at this time a strain of this type had been selected at Harrow from some material imported through Ottawa from Manchuria. This strain appeared to be reasonably pure and as it gave indications of promise was named Harman and released in 1943. Harman was rapidly accepted by growers and played a part in expanding the soybean acreage. Harman is still being grown extensively in some areas. During the 1940's several United States varieties were imported and grown to some extent. These included some maturities for which no Canadian varieties were available but recent years have seen a decline in the use of these varieties.

Since its introduction Harosoy has gained popularity very rapidly. In 1951 only four bushels of seed were planted. By 1956 the main soybean growing district of Ontario was about 75 per cent sown to Harosoy with certain areas such as Pelee Island as high as 90 per cent. Not only has Harosoy been accepted in Ontario but also in the United States. Ohio, Indiana, Illinois, Missouri, Nebraska, South Dakota, and Minnesota placed Harosoy on their list of varieties recommended for planting in 1956. The U.S. Department of Agriculture has accepted Harosoy as a

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Mr. Owen is a Soybean Specialist with the Experimental Farm, Harrow, Ont.

Soybean test plots, Experimental Farm, Harrow, Ont.

registered variety in recognition of its contribution to the soybean industry.

The fact that Harosoy is a good yielding variety is illustrated by the 67.9 bushel per acre yield achieved by a Pelee Island grower in the 1955 Ontario High Yield Soybean Contest. This is presumed to be a North American yield record. In this contest 9 of the 14 district finalists grew Harosoy while 3 grew Hardome.

The variety Hardome has found a place in the area where early maturity is required. While Hardome may never be as extensively grown as Harosoy, on account of its early maturity, it is proving to be a useful variety in the early maturing class.

In the search for new varieties at Harrow several factors are considered. Different maturities are required by Ontario growers and therefore promising lines having a range of maturities are maintained. Promising lines and varieties are also obtained from the U.S. Soybean Research Laboratory and are incorporated with our own breeding material. Agronomic qualities such as yielding ability and plant type are considered carefully although these are difficult to determine in seasons when weather conditions depress plant growth. Seed characters such as color, oil and protein content, and iodine number also receive attention.

The degree of prevalence of the more common soybean diseases is noted. While a number of soybean diseases have been found in the district only one or two, have, on occasion, become serious. Seasonal conditions appear to have considerable influence on the extent of soybean diseases although some varietal tolerance has been found. For example the varieties Harosoy and Harman have shown less infection with stem canker than some other varieties in seasons when this disease was evident. The recently isolated and named Phytopthora rot has caused some concern during the past season. Promising new strains are on hand which include in their parentage varieties resistant to this disease and these are being carefully observed.

Long-term Project

Progress in the development of soybean varieties has been achieved only through years of research. Work at Harrow was begun in 1923 with a collection of about ten varieties. Preliminary variety testing and some cultural experiments comprised the earliest work, with some plant selections being made as the work progressed. Selection led to the naming of the A. K. (Harrow) variety about 1928. This variety was selected from a mixed type called A.K. or All Kinds. A.K. (Harrow) was a full-season variety for the Harrow district. It was tall growing and had a tendency to lodge, but it served a useful purpose as one of the few fairly good varieties available at that time.

In 1931 the first attempt was made to artificially cross varieties. In 1936 a cross was made between Mandarin and A.K. (Harrow) from which several lines were selected. In 1941 one of these lines was backcrossed to Mandarin and from this a number of lines were selected in 1945, among them Harosoy and Hardome.

The soybean flower is small and rather easily damaged through handling. It is also normally self pollinated. These conditions tend to reduce the number of successful crosses made and where seed is obtained this must be grown on to the second generation to be certain that a cross has been obtained. In order to facilitate this work the crossing material has been grown in pots, making three different dates of planting in each pot. This provides flowers over a longer period and permits the pots to be brought indoors for making the crosses. When segregation is obtained in the second generation these crosses are carried on in bulk populations until the fifth generation before any plant selections are made for testing. The plant selections are grown in plant progeny rows for observation and the best of these entered in preliminary tests for yield and other characters.

Field of Harosoy grown for production of registered seed.

A field of Vicar oats showing a panicle of Vicar (inset). Seed of this new variety will be available for distribution this year.

VICAR - A New Hulless Oat

J. N. Welsh

VICAR, a new hulless oat will be available for distribution this year. It is the result of a single-plant selection made from the original Garry variety, and was discovered in 1946 by Mr. George MacVicar in a seed plot grown on his farm at Portage la Prairie, Manitoba, hence the name Vicar. The selection was increased by Mr. MacVicar in 1947 and the seed was forwarded to the Cereal Breeding Laboratory at Winnipeg for testing purposes. It was found to be impure in its reaction to stem rust and crown rust and to give a moderately resistant reaction to smut. To purify the variety, 94 pure-line selections were tested for reaction to race 45 of crown rust in the greenhouse, and to all races of stem rust in the field. Race 45 was used in the greenhouse because from previous studies it was known that resistance to this race also indicated resistance to the majority of the other races. Fifty-nine selections survived these tests and now form the basis of the present foundation lines of Vicar oats. In addition, a bulked portion of each of the 59 lines furnished a supply of pure seed for tests since 1951.

Mr. Welsh is an Oat Breeding Specialist with the Cereal Breeding Laboratory, Winnipeg, Man.

Vicar has the same rust resistance as the new Garry; that is, it is resistant to all races of stem rust and to the majority of the crown rust races. In recent tests it has also shown good resistance to smut. However, it is very susceptible to blast, a physiological disease that affects the panicles, causing only white thready tissue to form instead of the normal spikelets and kernels. This disease affects late maturing varieties more than early ones but does not appear to reduce yields appreciably, because the remaining kernels grow that much larger. Vicar is later maturing than Brighton or Torch, has a taller, but stronger straw, and owing in part to its greater rust resistance produces much higher yields in the rust areas of Western Canada.

A small increase plot of Vicar was grown in 1955. The seed sown was hand-picked to remove any hulled kernels that may have been present. Approximately six bushels were harvested, all of which was sown on ten acres in 1956. The seed from this increase is to be distributed in 1957. At the time of writing, however, the exact amount of seed that will be available for distribution is not

known, but a conservative estimate would be between 400 and 500 bushels. This is not a large increase but as the demand for hulless oats is limited it should satisfy the need of most of those who wish to grow hulless oats.

Hulless oats yield approximately 25 per cent less than hulled varieties because of the absence of hulls, but produce much heavier bushel weights. In yield of groats, on the other hand, there is little difference, if any, between high yielding hulless oats and ordinary oats. For five tests in the rust areas of Manitoba and Saskatchewan over the two-year period, 1954-1955, Vicar gave an average yield of 73.7 bushels per acre while Brighton and Torch yielded 57.2 and 52.2 bushels, respectively. In other parts of Saskatchewan the yields of Vicar compare favorably with those of Brighton. In Alberta, tests have indicated that Vicar is lower yielding in that province than Brighton. Data are not available for Torch in these areas.

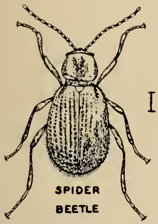
Hulless oats are used mainly as a feed for young pigs and poultry, since the excess fiber of ordinary oats in the ration of these classes of livestock has little nutritional value. In addition, excess fiber fed to weanling pigs often acts as an irritant, and for poultry it forms an indigestible bulk that limits the intake of more digestible nutrients required for growth and egg production. On the other hand, fiber is an advantage in the later stages of finishing young pigs as it curtails excessive fattening.

Author examining new oat varieties for rust resistance.

There are a number of problems associated with growing hulless oats. Since they tend to heat in storage, hulless oats must be harvested when well ripened and stored only when well dried. This is a limiting factor in their production. They are not satisfactory for milling purposes, because the kernels, lacking a protective hull, readily collect dust at threshing time. Millers prefer to dehull the commonly grown oat as they obtain a cleaner sample, which is essential for their purpose. Another problem that confronts the grower of hulless oats is that all varieties tend to produce some plants with hulled kernels. Therefore in order to maintain pure seed stocks of a hulless variety, all hulled kernels should be removed before seeding. This brings up the question of the need for establishing a tolerance, in hulless oats, for hulled types. No such tolerance exists at the present time. Other matters that may have to be dealt with are bushel weight and grade. If hulless oats become more widely grown, a separate standard for bushel weight as well as separate seed grain standards may have to be established.

Against these disadvantages hulless oats have a greater energy producing value than hulled oats, and may have a more important place in the farm economy of the future. The new Vicar appears to be a promising addition to the hulless varieties.

Effects of rust on three hulless oat varieties.—Top (left to right): Vicar, Torch and Brighton oats grown from rust-free plants. Bottom pictures show the effect of rust on these varieties, Vicar being most resistant.



(Greatly enlarged)

PROTECTING FLOUR From INSECTS

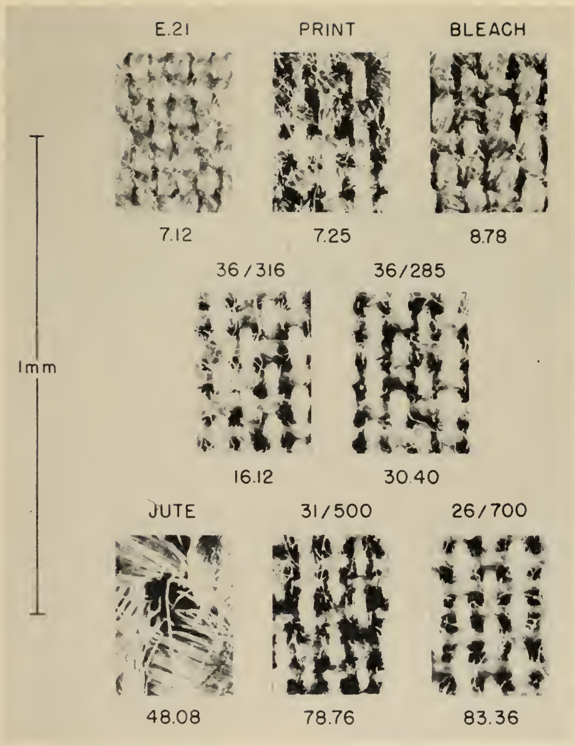
F. L. Watters

INSECTS commonly infest flour packed in cotton and jute bags by laying eggs through the mesh or by entering the closures and seams. The amount of infestation seems to depend on the type of weave used in manufacturing flour sacks. Bags made from finely-woven fabrics appear to protect flour stored in warehouses from infestations of the hairy spider beetle better than sacks made from coarsely-woven materials.

In a survey of flour warehouses fewer insects were found on closely-woven bags than on bags manufactured from coarsely-woven fabrics. This survey led research men to believe that finely-woven bags were less suitable as sites for feeding and egg-laying than the coarser material and that the finer fabric would resist egg laying or oviposition. Sacklets of one-pound capacity were manufactured from seven cotton fabrics and one of jute. Twenty-five sacklets were made from each material, filled with flour and placed in warehouses known to be infested with the hairy spider beetle. After a sufficient period these sacklets were collected, and the flour sifted for insects. The average number of spider beetles found in the bags varied from seven in those made of the finest fabric used in the test, to eighty-three insects in bags made of coarser material.

Although paper bags and plastic bags may protect flour from insects, these materials are relatively expensive and there is danger of paper bags ripping open. Also, many consumers prefer flour packed in bags made from cotton as this material can be used as aprons, or for some other household purpose.

Flour manufacturers are keenly interested in seeing that their products reach consumers, free of insects. Usually, flour is transported by rail or truck to warehouses where it is stored until purchased by consumers or delivered to some retail outlet. Shipments may remain in warehouses from several days to several months depending on demand. During storage, flour may become infested with insects unless warehouses have been properly treated with a suitable insecticide.



Fabrics tested. Underneath figures indicate average number of spider beetles per bag; overhead figures represent trade number of cloth type. The "Print" fabric, although coarsely woven, afforded relatively good protection. This cannot be explained on the basis of physical barrier only. The explanation may be in the nature of the dye used in printing bags. This aspect is being investigated.

The author is Officer-in-Charge of the Stored Product Entomology Laboratory, Winnipeg, Man.

THE influence of environment in poultry breeding has an importance that has not been fully appreciated. Only recently have breeders begun to pay sufficient attention to this factor in their breeding and testing programs. In making comparisons of the economic worth of various strains it is necessary to control such environmental factors as location and feed and to determine whether strains react similarly in the normal range of environments met in the field. Also necessary is the provision of some type of control so that a breeder can estimate the genetic progress he is making with his selection program, independent of uncontrollable year-to-year environmental fluctuations.

Experiments carried on by the Poultry Division, Experimental Farms Service, have shed some light on these problems. The experiments were designed so that rather precise estimates of the strain effect, the location or environmental effect, and the interaction of the two effects with respect to egg production and related traits of economic importance, could be made.

The term interaction may need further clarification. Obviously the poultry breeder's program is much more complicated if strains respond differently to varying location influences. An interaction would be considered to exist when two strains A and B are being compared at two locations and it is shown that Strain A performs the best at one farm while at another location Strain B performs best. The breeder would then have to develop a different strain for each of these specific environments, if each farmer was to be supplied with the best strain for his conditions. If these interactions do not exist, or are of minor importance, the poultry breeder can select his strains by testing them under average conditions, knowing they will perform in the same relative manner on his customers' premises.

While there has been some evidence of interaction as between strain and environment, it can be concluded from the studies that these effects are of minor importance. The studies did show, however, that: (1) very large differences existed between the genetic ability of the different production strains to lay eggs, and (2) that there were very large environmental (location) effects. In some experiments the location effect was larger than the strain effect while in others the strain differences were greatest. In the experiment reported in Table 1 the difference in survivor egg production between the highest performing strain A (219) and the lowest D (160) was greater than between the best farm (Morden—212) and the poorest (Agassiz—171). Note, however, that the location and the strain effects were both important in determining the egg production.

Although it is easy to explain that two strains differ in their ability to lay eggs because they were bred differently, it is more

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Dr. Gowe is a Poultry Geneticist with the Poultry Division, Central Experimental Farm, Ottawa, Ont.

Trapnesting (above) to obtain the individual egg the hen. At left is trapnest record with egg ma egg production record being accumulated. Shown hatching to identify the

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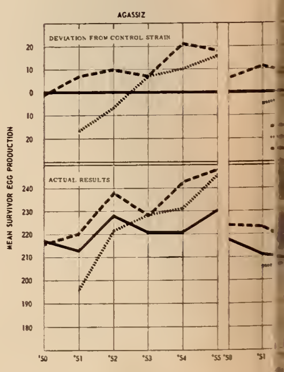
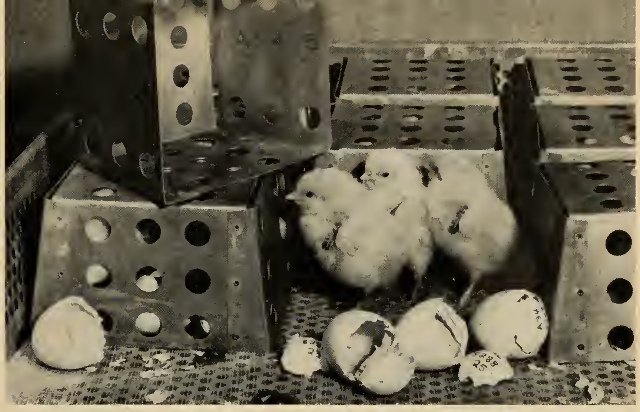
Problem In P

R. S



Mean survivor egg production of two s for five generations at three Farms. production and also the genetic tren selected lines from t



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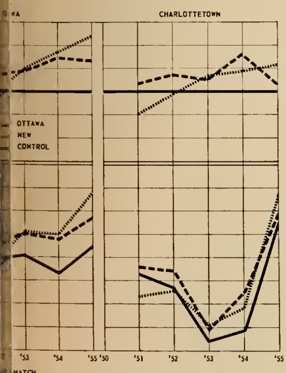


...strains and the Control strain on test ...plotted to show the actual mean egg ...wn by plotting the deviation of the ...trol strain each year.

difficult to try to explain why the performance of whole flocks at the different farms was so different. These location differences occurred despite the fact that rations and other important management factors were kept similar at the different locations. Apparently there are many environmental factors influencing egg production that have not been properly recognized as yet and given the attention they warrant.

These experiments suggest that commercial poultrymen should buy only the best strains of chickens and attempt to maintain the best environments if they are to obtain maximum performance from these strains.

More research is needed, howere, on the causes of the pronounced location differences that were repeatedly found in these experiments. The general lack of appreciation of the causes of differences between locations has been carried over into the field of breeding, and confusion still exists in the minds of some breeders. The records of individuals, strains and flocks on test at two locations are often compared directly. Differences between groups are almost always attributed to genetic differences, with little thought given to the role of environment. This points up the necessity of maintaining a Control strain for the purpose of comparison.

For use in comparison experiments, such a Control strain has been bred at Ottawa since 1950 without any artificial selection. Male and female breeders are selected at random and at no stage is there any culling. More than 40 males and 200 females are mated at random by the use of artificial insemination to reproduce each generation of this Control strain. Differences in performance from year to year are considered to be caused by environmental differences. It is assumed, of course, that the Control strain will not change genetically from generation to generation. Chance genetic changes of importance in a population of this size with the large number of genes influencing such a trait as egg production, should be very small. Over many years there may be slight changes in such a population caused by natural selection or genetic drift but these changes would not be large and would not affect the practical use of the Control strain.

Using this Control strain and two other strains, one with a relatively narrow genetic base and one with a wide genetic base, a selection experiment has been in progress for six years at Ottawa and co-operating Branch Farms. One of the strains (Ottawa strain) is a strain of S. C. White Leghorns that had been under selection at Ottawa for over a decade at the start of this test; the other (New strain) was made by crossing 7 Canadian R.O.P. strains of S. C. White Leghorns in all possible combinations in 1950. Both strains have been selected in a combination of sib and progeny performance as well as individual performance, using the same number of breeding pens and the same selection procedures.

Although all the breeding of the two selected strains (Ottawa and New) and the Control strain has taken place at one location, the progeny of the three lines have been reared and tested at several Branch Farms. By raising progeny from the Control strain along with progeny from each of the two selected lines, it has been possible to measure the genetic changes that take place independently of uncontrollable environmental fluctuations at the test locations. Since the three strains have been hatched, reared and housed together each year, it was valid to compare, at each Farm, the changes being made in the selected lines by the selection program, with the performance of the Control strain at that Farm. It is just as though the same selection program was being repeated at several locations.

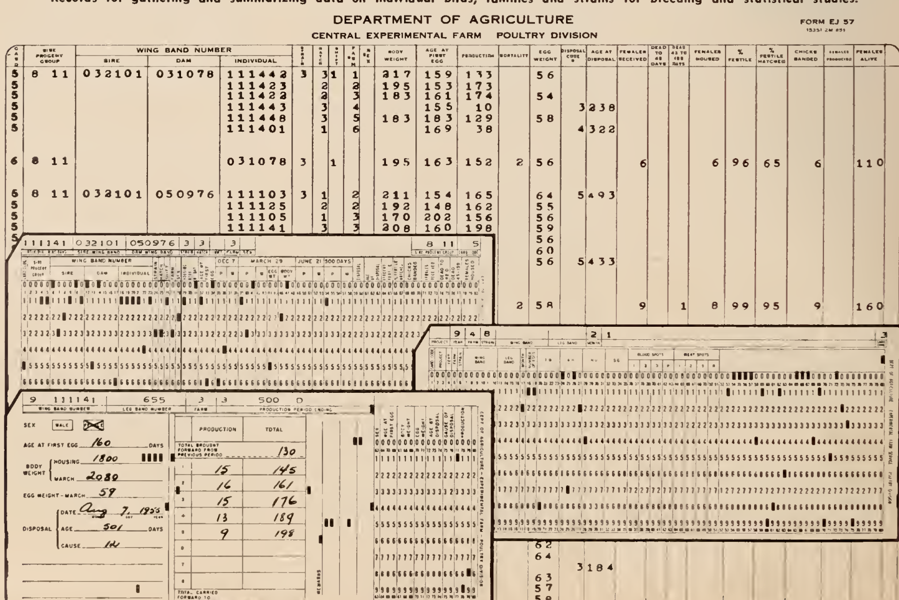
Since the Control strain was bred so that it would not change genetically from one year to the next, any change in performance of the progeny would be considered due to changes in the environment. Management may vary with changes in personnel; housing may improve; weather may change for better or worse; and rations may vary, depending on quality of ingredients. These and many other factors will interact to affect the performance of the stock and usually in a different manner at each farm. The Control strain would respond to the total effect of these environmental conditions in either a positive or a negative direction. The best measure of the genetic changes taking place in the selected strains over a number of years would be the difference in performance between the Control strain and the selected strains, and not the actual trends in the performance of the selected strains.

Table 1.—Mean hen-housed egg production (to 500 days of age) of 4 strains of S.C. White Leghorns on test at 4 farms

Strain	Experimental Farm				Mean
	Morden	Ottawa	Agassiz	Charlottetown	
A	237	220	216	203	219
B	217	185	175	175	188
C	204	168	147	162	170
D	190	157	146	146	160
Mean	212	182	171	172	184

The practical value of the Control strain has been clearly demonstrated as can be seen by the results shown in Figure 1. The bottom half of each graph shows the actual mean survivor egg production records for each strain for the years 1950 to 1955. Despite the fact that all locations had a similar management program and all birds received essentially the same all-mash diet, the trends at the three Farms were quite different. Disease conditions at each location could have a large part to play in the results obtained.

Records for gathering and summarizing data on individual birds, families and strains for breeding and statistical studies.



Without the Control strain, it can readily be seen that three quite different interpretations of the effectiveness of the selection program being practised would have been suggested had the results from only one Farm been used. At Agassiz, the selection procedure would have been considered highly successful—in fact exaggerated. Selection at Ottawa would have appeared to produce a positive response in one strain and a negative one in the other. At Charlottetown, up until 1954, it could only be concluded that the selection program was failing to increase the egg production level. When the curves at the top of Figure 1 are examined, it can be seen how the same general conclusions can be drawn at each Farm when the mean performance of the strains is plotted as a deviation from the Control strain. Since there were only 200 Control strain birds on test at Agassiz and Charlottetown, while more than twice this number were on test at Ottawa, there is less sampling error associated with the trends at this location and the results for Ottawa closely parallel the pooled results for all the stations collaborating in this study. As a result of this work, we are recommending that poultry breeders use a Control strain to enable them to measure the true genetic trends in their populations.

This selection study has also shown that it was easier to make progress in the strain with the broad genetic base than with the strain with the narrow gene base although this conclusion must be considered preliminary with only six generations of this study completed. An important question remaining to be answered is whether this accelerated rate of progress would have resulted if the initial production level of the strain with the broad genetic base (New) was close to or superior to the strain with the narrow genetic base (Ottawa). An experiment to test this hypothesis is planned for the future.

A practical application of the principles promulgated by the research reported above is exemplified in the present organization of Random Sample Tests. Such tests have been in operation in the

(Concluded on page 12)

Author (left) discussing shell quality and cleanliness with Test Station manager, in the Station's air-conditioned egg room.

Production Tests For Poultry

Results of first central production test show wide range in performance of commercial chicks.

G. R. Wilson

THE final report of performance of the entries in the first Central Production Test presents an interesting account of the great variation that exists in the performance of commercial chicks offered for sale in Canada. The range in net profit per chick was from $3.95 down to $1.68. Livability throughout the test period ranged from 92.8 per cent to 69 per cent. In regard to egg production, a difference of better than five dozen eggs, per chick started, existed between the poorest producing entry and the best egg laying entry. The latter had an egg production record of 208 eggs per chick started, whereas, the lowest producing strain had a production of 146 eggs per chick started. Similar variation between entries existed in egg size and their feed efficiency in producing a dozen eggs.

The author is Chief of the Poultry Production Section of the Department's Production Service at Ottawa, Ont.

The test is an extension of the R.O.P. Poultry Policy operated by the department's Production Service. It is designed to provide facilities whereby breeders can secure an assessment of the performance of their stock in comparison with that of other breeders, under common management conditions, and thereby learn the factors on which they must concentrate in their breeding programs. Since the results of one test cannot be regarded as conclusive, details of the performance of individual entries will be released publicly only after further tests have been completed.

The first test house was constructed at Ottawa in 1954-55 and chicks for the initial test were hatched on April 1, 1955. A second house has since been completed. For the first test, 29 private breeders across Canada were represented together with one entry from the Central Experimental Farm, Ottawa. In conducting the tests, every effort was made to assure uniform conditions of

Above: **Interior of test pen showing location of feeder, roosts and nests.**
Right: **In Station's laboratory, eggs are weighed and tested for "interior quality".**

incubation, brooding, rearing and feeding. During the laying period accurate records were kept of the number of eggs produced by each pen. The eggs were weighed daily according to Canadian standards and one day's production each week was candled and graded by a commercial egg candler. From this data the revenue per bird was calculated.

All birds left in the test at the end of the 500-day period were put through a poultry processing plant, graded according to commercial standards and their value calculated according to the going prices for the appropriate grade.

Some interesting points emerged from the first test. To grow a chick to eight weeks of age required about 31 cents to pay for feed, brooding costs and equipment depreciation. Rearing costs from 8 weeks to 140 days averaged 73 cents and ranged from 63 cents to 88 cents per bird. Feed consumption during this period ranged from 12.6 lb. to 18 lb. per bird, an important consideration in rearing cost. Feed consumption per dozen eggs laid also showed wide variation from a low of 5.3 lb. to a high of 7.6 lb. Average feed consumption per dozen eggs throughout the test was 6.25 lb. Meat value at the end of the test averaged $1.07 per bird and ranged from $0.72 to $1.48.

The first test, which included all the commercially important egg breeds, indicated that there are a number of highly efficient egg-producing strains in Canada. The performance of the heavier breeds was assisted in that respect by the revenue from meat. Under the conditions of the Test, feed costs and egg returns from April 1st, 1955, to August 13th, 1956, the average net return over and above chick cost, per chick started, was $3.05.

ENVIRONMENT - Poultry Breeding Problem . . . *(from page 11)*

United States since 1949, and in Canada since 1954. The prime purpose of these tests is to provide a means for testing the stock of private poultry breeders under controlled environmental conditions. The tests are based on two principles: (1) To minimize the environmental differences, when comparing strains, so that true genetic differences can be measured; (2) To compare adequate random samples of strains rather than select individuals or families from those strains as has been done in the past in what are called "Standard Egg Laying Contests". The result provides a reasonably accurate estimate of the general genetic worth of the strain to the poultryman and to the industry in general. Although there are many details to be worked out in the design and operation of these tests, they are serving a real function in directing the attention of the chick buyer to strains of superior genetic worth. The demonstrated lack of a strain environment interaction, as brought out by our research provides the first critical evidence to suggest that: (1) It is not necessary to have Random Sample Tests over a wide range of locations to sample a diversity of environments; and (2) An adequately planned test at one location will provide a comparative evaluation of the strains of quite general applicability. The work has also shown that in such a Random Sample Test, as well as on the premises of commercial poultry breeders, a suitable randomly bred control strain is an essential if strains are to be compared on the basis of the results of the test without environmental effects being involved. The control strain evolved at the Poultry Division, of the Experimental Farm, is at present being used in the Canadian and some American Random Sample Tests for this purpose and will become available for Canadian breeders to use to control their breeding work.

Besides clearly demonstrating the need for Control flocks in poultry breeding research programs, these studies have also made us more aware of the large part that environment plays in determining the performance of any group or population. Significant progress can now be made in testing and comparing selection procedures that have been proposed, based on quantitative genetics theory.

Fertilized dykeland produces an excellent pasture sward.

Maritime Dykeland Has

Excellent Possibilities as Pasture

S. B. Williams

PRODUCTION of beef in the Maritime Provinces has received increased attention in recent years. The excellent forage producing potentialities of the area, coupled with rising labor costs, have been among the factors stimulating this interest. One of the focal points in this development has been the tidal marshlands of the Bay of Fundy which total approximately 82,000 acres and form an integral part of farming operations involving almost half a million acres.

These marshes have been built up over the centuries, not of decayed vegetable matter, but rather the best of mineral soils scoured from the neighbouring uplands, mixed in the Bay, ground, and reduced to uniform size by the action of the tide and then returned by the tide for use. They are level, deep, and fertile. When dyked to protect them from the sea, and adequately drained, these areas are capable of producing large crops of forage and since the time of the earliest settlers have been utilized mainly for the production of hay.

At the turn of the century many dykes and protective works fell into disrepair, but with the implementation of a Federal-Provincial program for the reclamation of these areas, interest in their utilization has been greatly stimulated. Concurrently changing social and farming patterns have made available considerable areas of upland—areas which would appear to be eminently suited to the production of beef.

Grazing Experiment

Since no information was available on the productive capacity of this dykeland in comparison with upland it was decided to conduct a beef grazing trial at the Experimental Farm at Nappan, Nova Scotia. Land was obtained adjacent to the Experimental Farm consisting of approximately 20 acres of dykeland, with an equal amount of contiguous upland. The dykeland is classified as Acadia Clay and the upland as Tormentine Sandy Loam; these soils are representative of much of the land available for grazing purposes. While accurate records were not available investigation disclosed that most of this area had received little, if any, lime or applied fertility for many years. The entire block was in sod and this was left undisturbed, although standing hay and grass was mowed and removed.

The experimental area was laid out in acre fields with treatments being replicated three times and randomized within blocks. Each treatment was repeated on the two soil types, making six fields for each treatment, three on upland and three on dykeland. The check plots received no fertilizer or cultural treatment while the lime and fertilizer plots received an annual application of one-half ton of agricultural limestone and 200 pounds of 20 per cent superphosphate per acre annually. In 1952, the year prior to the start of the experimental grazing, the fertilized plots received an application of one-half ton of limestone and 600 pounds of superphosphate per acre. All lime and fertilizer applications are made on the sod as early as possible in the spring.

Yearling Hereford steers are used as grazing animals. These steers are brought from the West each fall as calves and are run together in a loose-housing barn for the winter. During this time they receive a daily allowance of approximately ten pounds of hay and two pounds of oats. When hay quality is poor, linseed oilmeal is

General view of trial. Dykeland pastures in foreground, upland in rear.

Mr. Williams is Superintendent of the Experimental Farm, Nappan, N.S., and an Animal Husbandman.

added to the ration. The rate of gain during the winter months is stabilized at approximately 0.35 pounds per head per day.

During the grazing season the animals allotted to a treatment graze the treatment replicates in sequence, the amount of time spent on each replicate being determined by the rate of growth of herbage. All plots are grazed to maximum utilization and the rate of gain of the stock on the different treatments is kept as nearly constant as possible through the removal or addition of animals as required. Dry-matter yields of the pastures are also obtained through the use of yard-square cages.

It is felt that this work is producing valuable information on the productive capacity of Maritime pastures in terms of beef per acre. This basic information should greatly assist producers in evaluating the merit of possible changes in their production program.

At the present time four years' results are available:

Beef Gain In Pounds Per Acre.

(Average 1953-1956 incl.)

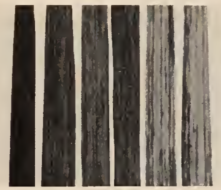
	Check	*Lime plus Superphosphate*
Upland	233	445
Dykeland ..	363	548

While this work is being continued in order to obtain results

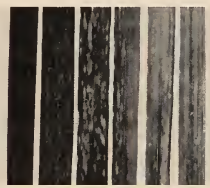
(Concluded on page 16)

Virus Diseases of Cereal Crops

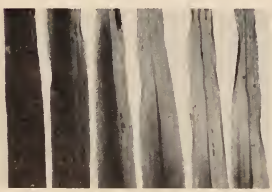
J. L. Slykhuis



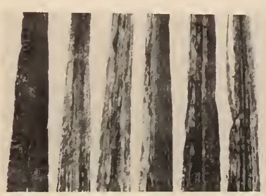
Symptoms of wheat streak mosaic on winter leaves (healthy at left).



Symptoms of wheat spot mosaic on Kharkov 22 MC wheat leaves (healthy at left).



Leaves of Campana barley showing symptoms of cereal yellow dwarf.



Symptoms of barley false stripe or stripe mosaic on Atlas barley leaves.

Few Canadian farmers are aware that viruses may cause losses in their grain crops. In fact until relatively recently plant pathologists have not realized that viruses have been the real cause of some of the losses in cereal crops formerly blamed on such varied things as frost, root rot, drought, heat, deficiencies or excesses of elements in the soil, insects, or even inherited abnormalities.

It was not until 1921 that a virus was recognized as the cause of a disease in wheat in the United States. Since then a number of other virus diseases have been recognized in cereal crops but the total number is still not large. When such diseases are recognized for the first time, we are inclined to talk of them as new, but it is likely that most of the virus diseases we know affecting cereal crops have been present since the early days of grain growing on this continent.

How Virus Diseases are Recognized

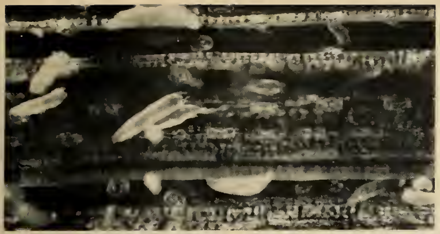
Viruses are so small that they cannot be seen with ordinary microscopes, but their presence is indicated by their effects on plants. Most known plant viruses impair or destroy chlorophyll, the all-important green pigment that enables plants to harness the sun's energy for synthesis of food. If chlorophyll is damaged or destroyed uniformly through the leaf, the leaf becomes generally yellow or bleached and is said to be chlorotic. Many viruses damage the chlorophyll in blotches, spots or streaks, thus causing a light green or yellow mosaic mottling, spotting or streaking. They usually reduce the vigor of plants they attack, and may cause deformities, stunting and even death. However, other things can cause similar symptoms on plants. It is important for the scientist to be able to transmit a virus under controlled circumstances in order to establish that the disease is caused by a virus rather than by something else.

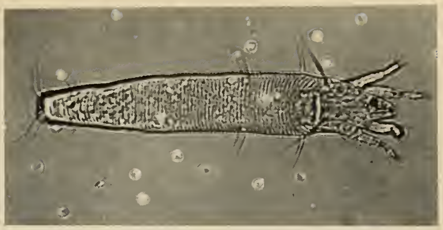
How Plants Become Infected with Viruses

There are several ways in which viruses are transmitted from plant to plant, but each virus is

Author inoculating wheat plants.

Dr. Slykhuis is a Plant Pathologist with the Science Service Laboratories, Lethbridge, Alta., specializing in virus diseases of cereals.





Left: An enlarged portion of a wheat leaf showing eggs and various stages of *Aceria tulipae*, the mite that carries the wheat streak mosaic virus. *Right:* A high power microscopic view of an adult mite (*A. tulipae*). Actual length of mite is only 1/100 inch.

so specific that it can be transmitted in only one or a few of the known ways. The first viruses studied on wheat and oats were found to be harbored in the soil and transmitted to the plants in some mysterious way. Others are carried only by certain species of leaf hoppers. None of the 4 viruses known to attack cereal crops in Canada are transmitted by either of the above methods. Two are carried by mites, one by aphids, and one in the seed.

Wheat Viruses Transmitted by Mites

The wheat streak mosaic virus, so named because of the light green to yellow streaks it causes on the leaves of diseased plants, has been known as a destructive disease of winter wheat in Kansas and neighbouring states since 1932. The virus can be artificially transmitted by rubbing the sap from diseased plants on healthy ones, but the natural means of transmission was not discovered until 1952. In that year the disease was found in Alberta, and a few months later, *Aceria tulipae,* a 4-legged worm-like mite, less than 1/100 inch long and therefore scarcely visible to the unaided eye, was proved an efficient vector of this disease. Another virus transmitted by the same mite was found usually together with the streak mosaic virus. The new virus, named "spot mosaic" because of light green to yellow spots it causes in the early stages of the disease, has not been transmitted by artificial methods that so readily transmit streak mosaic. The disease called "wheat streak mosaic" which occurs in Alberta is therefore a complex of two viruses. But this fact is not important to the farmer so long as both viruses can be controlled by the same methods.

Losses from wheat mosaic have been very severe in many crops of winter and spring wheat in southern Alberta. In addition to the yellow mosaic symptoms described above, plants may be severely stunted, and if infected when young, they may even die before heading. Often wheat crops have been complete failures because of this disease. Many plants of the grass family can be infected, but wheat is the only severely damaged crop plant. Wheat mosaic is severe only in areas where winter wheat is grown, because winter wheat is the most suitable host known on which the viruses and the mite can overwinter. Mites that survive the winter can carry the viruses to other winter or spring wheat plants on which they multiply rapidly during the summer. Both the mites and the viruses need a continuous supply of green plants of a susceptible species, principally wheat, in order to survive. The disease can be controlled by keeping the land free from disease-carrying green wheat for a week or more before wheat is sown in the same or adjacent fields. There is usually great danger of mosaic infection in winter wheat sown early in August because of the abundance of spring wheat and other immature wheat that may be harboring mosaic at that time. There is little danger of mosaic infection in winter wheat sown between September 1 and 15, which is the recommended time for sowing winter wheat in southern Alberta.

Cereal Yellow Dwarf Caused by an Aphid-Transmitted Virus

In 1951 an aphid-transmitted virus was proved to be the cause of the cereal yellow dwarf disease which caused economic losses in barley, oats and wheat in California. The causal virus can be transmitted by at least 5 species of aphids: the corn aphid (*Rhopalosiphum maidis*), the apple grain aphid (*R. prunifoliae*), the English grain aphid (*Macrosiphum granarium*), the grass aphid (*M. dirhodum*), and the greenbug (*Toxoptera graminum*). The virus has not been transmitted in any way other than by aphids.

The symptoms caused by cereal yellow dwarf on barley and wheat consist of a yellowing

Left: Winter wheat that is healthy (left) and severely diseased with wheat streak mosaic (right) collected in a farmer's field in February and grown in the greenhouse for about 3 weeks. *Center:* False stripe symptoms on Atlas barley 3 weeks after the plants on left were inoculated; healthy plants at right. *Right:* Black hulless barley plant infected with cereal yellow dwarf virus (left) and not infected (right).

of the leaves starting at the tips and progressing downward. In oats the chlorotic foliage tends to redden. Susceptible varieties of grain may be severely stunted when infected at an early age. The best control appears to be the planting of resistant varieties, and planting early so that the crops have a good start before aphids become abundant.

Many adverse conditions such as excess moisture, drought, shortage of nitrogen, root rot, etc., can cause symptoms somewhat similar to those caused by the yellow dwarf virus on grain crops. Therefore, the only certain method of diagnosis is to transmit the virus to a susceptible host by one of the aphid vectors. The cereal yellow dwarf virus has been detected in barley, oats, and wheat in Canada, but no estimates have been made on the amount of damage attributable to the virus.

Barley False Stripe Virus Carried in the Seed

Barley false stripe is the only known virus disease of cereal crops that is carried in the seed. This disease was observed in Canada as long ago as 1924, but it was considered to be non-infectious. In 1950, however, it was proved to be caused by a virus that could be transmitted easily by rubbing the sap from diseased plants onto healthy ones. Plants may become infected in the field by rubbing against diseased ones. There is some evidence that the virus can also be carried in the pollen. Once plants become infected the virus can pass on to the next generation through the seed. Barley grown from seed carrying the false stripe virus may show a whitish speckled type of mottle or irregular whitish stripes any time after emergence. Sometimes visible symptoms do not develop on infected plants. The disease often shows up strikingly in the field when the diseased plants are headed and the leaves have developed stripes of white and brown. Badly diseased plants are usually stunted, and the kernels less plump than those from healthy plants.

Barley false stripe is a serious disease in some seed lots of barley and is responsible for a significant reduction in the yield of some varieties. It may also cause some damage in wheat. The virus may be distributed as widely as the infected seed, and although it has been recognized only in Canada, the United States and England, it seems possible that it could occur wherever barley is grown.

Some scientists are trying to develop varieties resistant to false stripe virus and others are trying to find methods of treating the seed to eliminate the virus. However, the best control so far is to discard badly infected seed and plant seed free from the virus.

Other Viruses Affecting Cereal Crops

Viruses carried in the soil and transmitted by leaf hoppers are known to affect cereal crops in other countries. It will not be surprising if similar ones are found in Canada. It is also likely that viruses will eventually be proved to be cause of some of the spots, blotches and mottles that mystify plant pathologists at the present time.

* * *

Pasture *(from page 14)*

as free from seasonal differences as is possible, the following observations would seem to be valid at the present time:

1. It is possible to greatly increase the yield of beef per acre on upland pasture with modest applications of lime and superphosphate. For the four years the production has been essentially doubled by the treatment.
2. Untreated dykeland has produced over 50 per cent more pounds of beef per acre than has adjacent upland.
3. Dykeland, treated with lime and superphosphate, has produced excellent pasture as is evidenced by the average annual production per acre of 548 pounds of beef gain.

It is worthy of note that the results in terms of pounds of gain per acre have been quite consistent from year to year. For example, the total gain per acre from the limed and fertilized dykeland has varied only from a low of 507 pounds in 1955 to a high of 583 pounds in 1953, while on untreated upland the largest difference between years is only 28 pounds.

Field-grown Kharkov 22 MC winter wheat showing varying degrees of stunting caused by wheat streak mosaic.

Plot (right) sown beside diseased winter wheat on July 28 was ruined by wheat streak mosaic. Plot (left) was sown on August 25, after the diseased crop nearby had matured, hence it escaped severe damage from the disease.